

Crystalline Silicon Solar Cells: Leapfrogging the Barriers

Preprint

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Crystalline Silicon Solar Cells: Leapfrogging the Barriers

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Silicon solar cell technology has greatly advanced in the last three decades – from merely concepts to a full-fledged industry. The performances of commercial cells and modules are now at levels that would have been very difficult to imagine just a few years back. At the same time, PV energy sales are expected reach 1 GW/yr in the near future, and there has been a rapid drop in the selling-price of PV modules. This is indeed astounding progress. However, this path has not been easy or free from obstacles and bottlenecks. There have been numerous difficulties and barriers in the science and technology of photovoltaics, as well as on the business end. For example, there have been times of insufficient funding, limited R&D resources for universities and laboratories, and a shortage of feedstock. Si-PV has overcome these hurdles and many other barriers. The PV industry has weaned itself away from the microelectronics technology, many new techniques of crystal growth and low-cost cell fabrication methods (suitable for PV) have been successfully applied, and mc-Si cells are nearing the efficiencies of CZ-Si wafers. On a more technical side, perhaps the most intriguing achievement is the development of the science and technology for making high-efficiency cells on low-quality material through gettering and impurity/defect passivation. Si-PV is continually on the path to lower costs and to be competitive with conventional sources of electric energy. Hopefully, this most significant barrier, of meeting the conventional energy cost, will be surmounted in the near future.

Clearly, Si-PV technology has not only survived, but been quite successful thus far. The theme of this year's workshop was selected to emphasize the resilience of the Si technology (in general) and Si-PV (in particular). Furthermore, because our workshop also addresses industry's R&D needs, we have changed the title of the workshop (as in the past) to *Workshop on Crystalline Silicon Solar Cells and Modules: Materials and Process*, thereby including some module activity that is pertinent to better solar cell designs.

In keeping with this theme, the special sessions of this workshop emphasize the innovative culture in our Si-PV community. Many sessions are somewhat general, but we have special sessions on Si feedstock (which seems to be popping up again as the microelectronics industry is trying to rebound), novel doping and heterojunctions, and metallization/SiN:H processing. Characterization and process monitoring continues to be important for cost reduction. We have also included a session on module issues and reliability to emphasize the need for optimum cell design including the module constraints. Last year's rump session seemed to be quite successful in generating a list of R&D problems and possible solutions for reaching higher efficiencies. This year's Rump Session will address the efficiency expectations for c-Si-PV and challenges in meeting such expectations.

Finally, as in the past, this workshop has set directions for the NREL/DOE Si program. This year, the workshop will help to identify the goals/tasks for the new 3-year University Research Program. I hope you enjoy the presentations and discussions during the workshop, and that you will help establish directions for the Si-PV program. As always, the poster sessions are full of the latest excellent research results. I am sure you will enjoy the scientific details and new technologies.

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